

Site: _____
Break: 1.2
Other: 7/15/77?

LAKE HARTWELL PCB REPORT

In 1975, the South Carolina Department of Health and Environmental Control (DHEC) found polychlorinated biphenyls (PCB) in the Pickens, South Carolina water supply. This discovery precipitated a series of physical, chemical and biological studies conducted through the joint effort of DHEC, Georgia EPD, COE, USFWS and EPA. The studies showed that PCB concentrations in the edible tissues in some of the Lake Hartwell fish exceeded the United States Food and Drug Administration's (FDA) recommended safe tolerance limit of 5.0 parts per million (PPM). On August 13, 1976, a joint DHEC/EPA public health advisory was issued, which warned the public of the potential danger of eating fish from Lake Hartwell. The advisory was revised in November of 1976 to include only the Seneca River arm of the lake upstream from the South Carolina Highway 24 bridge. That advisory remains in effect.

The investigation revealed that PCBs were being discharged into Town Creek by Sangamo Electric Company through their water treatment plant effluent. Town Creek discharges into the Twelve Mile Creek arm of Lake Hartwell. On October 13, 1976, DHEC and EPA directed Sangamo to discontinue the use of PCBs and to limit PCB discharge concentrations to background levels found in their raw water intake. Sangamo discontinued the use of PCBs on June 30, 1977, and their present NPDES permit requires a non-detectable (1 ppb) discharge limit.

To monitor the PCB concentrations in Lake Hartwell fish tissues, DHEC/EPA initiated an intensive fish sampling program in the spring of 1977. The purpose of the program was to monitor PCB tissue levels from a public health standpoint and tissue level trends over time. The original sampling program consisted of spring and fall sampling, at which time 25 individuals of each of 3 species (largemouth bass, white bass, catfish) between the sizes of 12" to 14" were to be collected from 6 stations on the lake. As is usually the case when sampling fish communities, the task was more difficult than first perceived. Consequently, numbers and sizes of fish did not always fall into the ranges required by the study plan. In addition, data gathered over time indicated that continued sampling at all stations was not necessary nor were the fall samples providing very useful information. The fall sampling was discontinued in 1979 and by 1982 only 3 of the 6 stations were being sampled on a regular basis.

The purpose of selecting fish from a particular size group (12" to 14") was to insure that fish belonging to the same age class were being analyzed over the years. Soon after the project was initiated,



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it became apparent that it was going to be impossible to gather a sufficient number of largemouth bass and white bass of a required size at all times. At that time, it was decided that the largemouth bass could be supplemented with coosa bass, and white bass could be supplemented with white bass x striped bass hybrids. Since coosa bass of similar age are smaller than largemouth bass, the size range was widened for this composite. The same situation exists with the white bass hybrid complex.

Figure 1 shows the location of the three stations from which the data presented here were collected. Station SV-107 is referred to as Twelve Mile Creek in this document; Station SV-532 is Camp Creek, and Station 535 is Andersonville Island. The directive regarding the potential danger of eating fish from the lake is in effect upstream from Highway 24 which crosses the lake approximately halfway between Stations SV-532 and SV-535.

The biological data are presented on Figures 2-7 and Tables 1-4. Whenever possible, 24 individuals from each species or group were collected at each station. These were composited in sets of four falling within the size limits required. Figures 2-7 show the mean, standard deviation, maximum minimum values and where the values lie in regard to the FDA action levels for these composites. Table 1 shows the results of the analysis of variance and Spearman's Rank Coefficient tests applied to the data to determine whether there were any trends over time. Tables 2-4 present data from fish that fell outside of the chosen size limits. This last group of fish are neither represented in the figures nor the statistical tests.

Trend analysis of the data gathered tends to be weak because of the low number of data and varying numbers of individuals throughout the 6 years of sampling. Following, however, are the observations gleaned from Figures 2-7 and Table 1.

Twelve Mile Creek (Figures 2 and 5 and Table 1)

- o Micropterus spp. (largemouth and coosa bass) show no upward nor downward trend in either the spring or the fall.
- o Morone sp. (white and hybrids) show a slightly downward trend in the spring, but it is not statistically significant at the 95% level. There are no trends in the fall sampled fish.
- o Ictalurus spp. (catfish) show a statistically significant downward trend in the spring sampling, but no trends for the 2 years of fall sampling.

Camp Creek (Figures 3 and 6 and Table 1)

- o Micropterus spp. statistically show a significant downward trend in the spring sampling, although a visual review of the data shows little overall drop. There is no trend in the fall sampling.
- o Morone spp. show a downward trend, but it is not significant at the 95% level. There is no trend in the fall sampling.
- o Ictalurus spp. show a significant downward trend in the spring, but no trends in the fall.

Andersonville Island (Figures 4 and 7 and Table 1)

- o Micropterus spp. show a downward trend, but it is not significant at the 95% level. There are no data for fall sampling at this station for the black basses that fall within the prescribed size limits.
- o Morone spp. show a significant downward trend in the spring sampling, but no trends in the fall.
- o Ictalurus spp. show a significant downward trend in the spring sampling and a slight upward trend in the fall sampling.

In summarization of the trend analyses, Ictalurus spp. have shown a significant downward trend at all three stations; Micropterus spp. have shown a significant downward trend at Andersonville Island and a slight downward trend at Camp Creek, but no trend at Twelve Mile Creek; and Morone spp. have shown a significant downward trend at Andersonville Island and a slight trend at the other two stations.

The true area of concern is the potential danger of eating contaminated fish. Because of the costly and time-consuming effort of analysis of fish tissue, four fish were composited for each analysis. The problem with compositing of fish tissue is that accumulation among individual fish varies considerably. Therefore, one can never be sure whether the value for a composite is a true value for any one fish in the composite or that all PCBs in the composite were contributed by one fish. That being the case, if the value for a composite is 1.25 ppm or greater, there is a possibility that a fish in that composite reached the FDA 5.0 ppm action limit.

Keeping that in mind, the concentrations of PCB's found in fish tissues during the last (1982) sampling period are presented below.

Twelve Mile Creek:

- o The average concentration of PCBs in the composites of edible tissue of Micropterus spp. falling within the prescribed size limits was 4.58 ppm. The range was 3.43-7.41 ppm. The average then was below the 5 ppm action limit, but if one considers the 1.25 ppm as a warning, all composites are of potential concern.
- o The average concentration in the tissue of Morone spp. was 5.72 ppm which is above the FDA action level. The range was 0.84-10.17. Only the 0.84 was below the 1.25 ppm. This particular series of five composites points out the weakness of compositing fish when dealing with accumulation of substances in fish tissue.
- o The average concentration of PCBs in 4 composites of edible tissues of Ictalurus spp. was 4.81 ppm. The range was 2.28 to 7.88 ppm. Of the four composites analyzed, two were above the 5 ppm level, and all were above the 1.25 ppm level.

Camp Creek:

The sampling for Micropterus spp. and Ictalurus spp. at Camp Creek was cancelled in 1982 because concentrations of PCBs in these species were well below the FDA 5 ppm limit and also below the 1.25 concern limit.

- o The average concentration of PCBs in the tissue of Morone spp. was 3.16 ppm. The range for 6 composites was 1.0 to 5.16 ppm. Of these, one was above the 5 ppm limit and four others were above 1.25 ppm.

Andersonville Island:

Micropterus and Ictalurus spp. were not sampled at this station in 1982 for the same reason as described under Camp Creek.

- o The average concentrations of PCBs in Morone spp. tissue was 2.3 ppm. The range of three composites was 1.6-3.0. None of the composites were above the FDA limits, but all were above the 1.25 ppm level.

In summary of the tissue concentration data of fish falling within the prescribed size limits, 6 of the 15 composites from Twelve Mile Creek were above the 5 ppm level, but 14 of 15 were above the 1.25ppm level. At Camp Creek where only Morone spp. were collected, one of six composites was above the FDA action level, but five out of six were above the 1.25 level. At Andersonville Island where again only Morone spp. were collected, no composites were above the FDA limit, but two of two were over the 1.25 level.

During the 6 years of sampling, a few large fish were collected and analyzed that are not included in the data discussed above. The results of these analyses are shown on Tables 2-4. The size (which is not shown in the table) varies considerably, but generally speaking, the fish were considerably larger than average fish taken by the sports fisherman. For example, the catfish taken from Twelve Mile Creek in 1982 weighed approximately 30 lbs, and the four largemouth bass also taken from Twelve Mile Creek in 1982 were about 4 lbs each. The results of the analyses show that these larger, and older, fish contain very high concentrations of PCBs in their tissue (Tables 2, 3 and 4). Since the strategy of this monitoring program has been to monitor the 2- to 3-year old fish, there has been no way to determine whether the fish older than the 3-year class are continuing to increase their body burden of PCBs. The small amount of data we have in these large fish suggests that they might still be increasing that body burden. At least they do not seem to be losing it very rapidly. It would seem advantageous at this time to closely scrutinize the on-going program to determine whether the thrust of the monitoring should be altered somewhat to determine whether the fish entering the harvestable population continue to concentrate PCBs in their tissue over time.

It is also suggested that there be more analyses of individual fish to measure variability of fish tissue concentration of PCBs.

TABLE 2. PCB CONCENTRATIONS OF ICTALURUS GREATER THAN 356mm.

Station	1977	1978	1979	1980	1981	1982
Twelve Mile Creek	34.7F	47.90 3.47F 2.07F	11.06 33.72 42.72 20.83	23.90 14.30	26.30 25.00 15.90	24.53 8.81 78.6
Camp Creek	16.0 0.30F	23.90	2.89 4.19	1.29	0.98	
Andersonville Island			0.78		<0.10 <0.20 0.32	

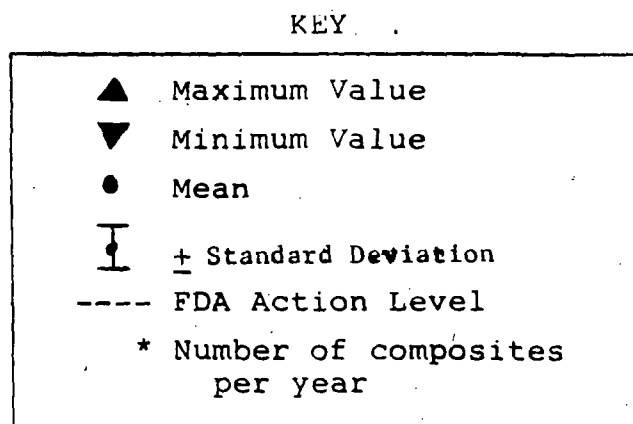
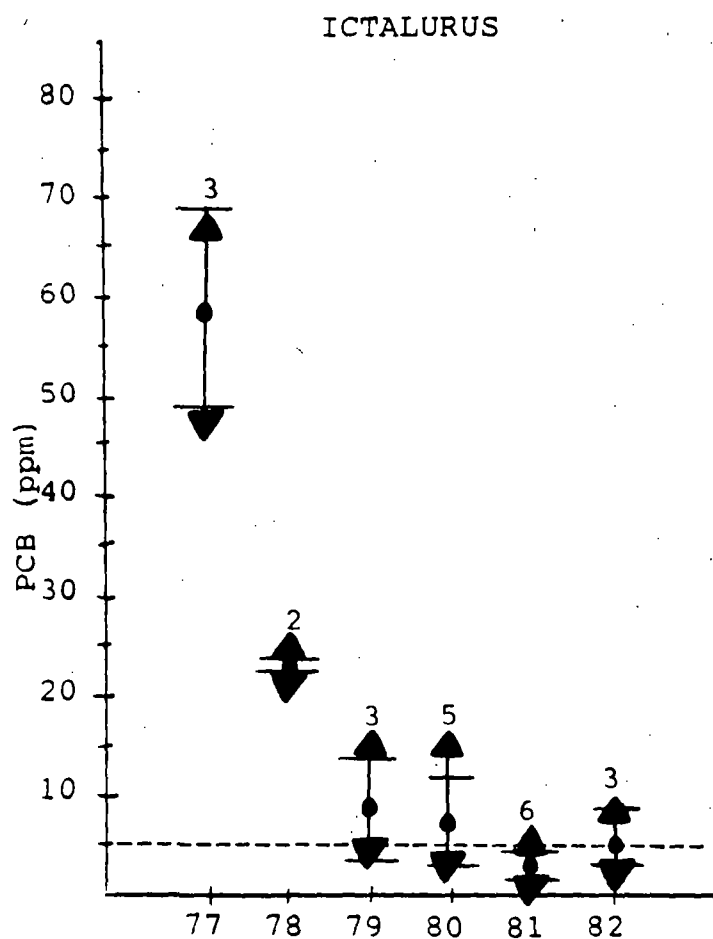
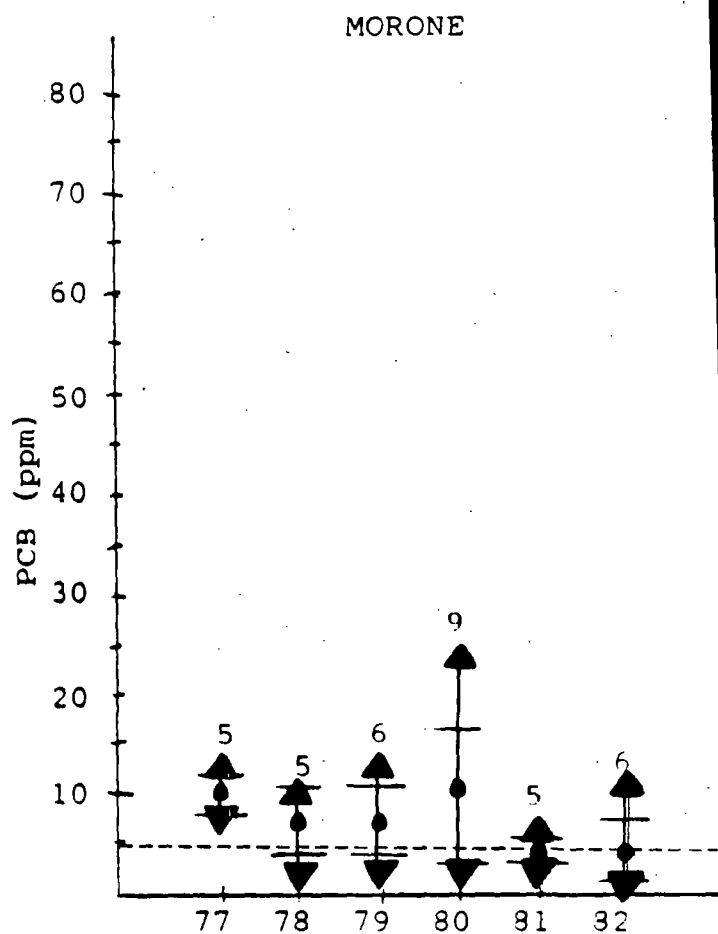
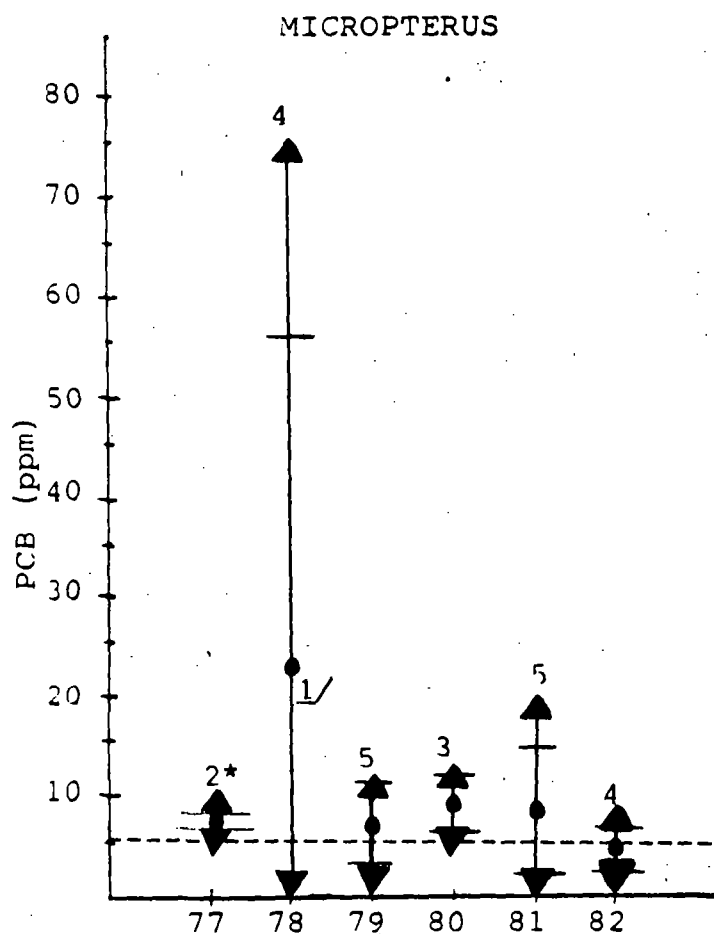
TABLE 3. PCB CONCENTRATIONS OF MORONE GREATER THAN 305mm.

Station	1977	1978	1979	1980	1981	1982
Twelve Mile Creek	7.0F					
Camp Creek			7.6F	8.10	1.91 1.32	
Andersonville Island		10.67 3.95	0.62F	0.48 1.54		0.52 4.55 3.77 2.19

TABLE 4. PCB CONCENTRATIONS OF MICROPTERUS GREATER THAN 406mm.

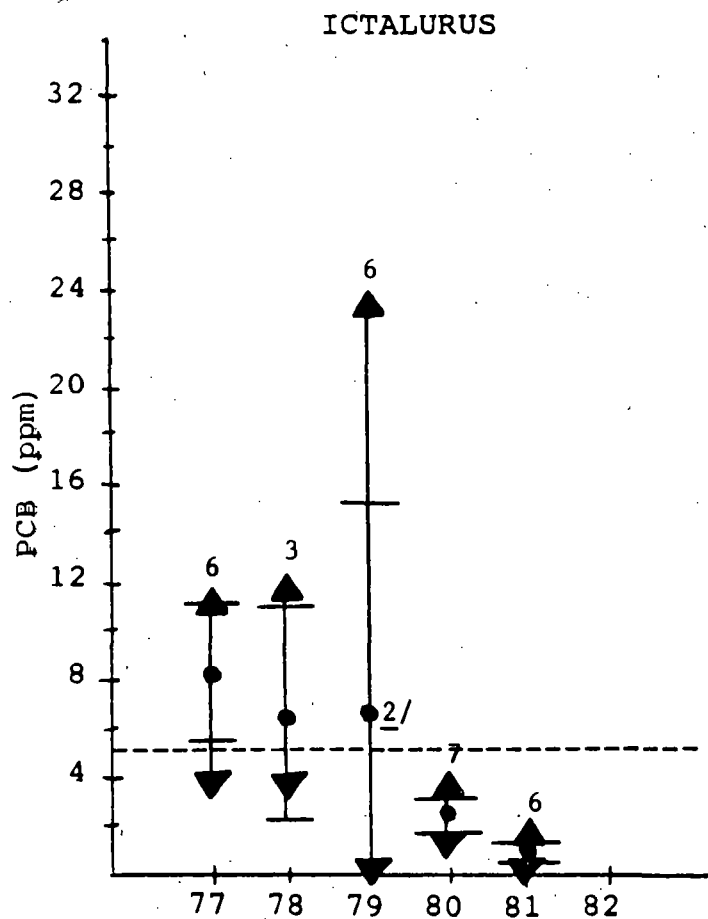
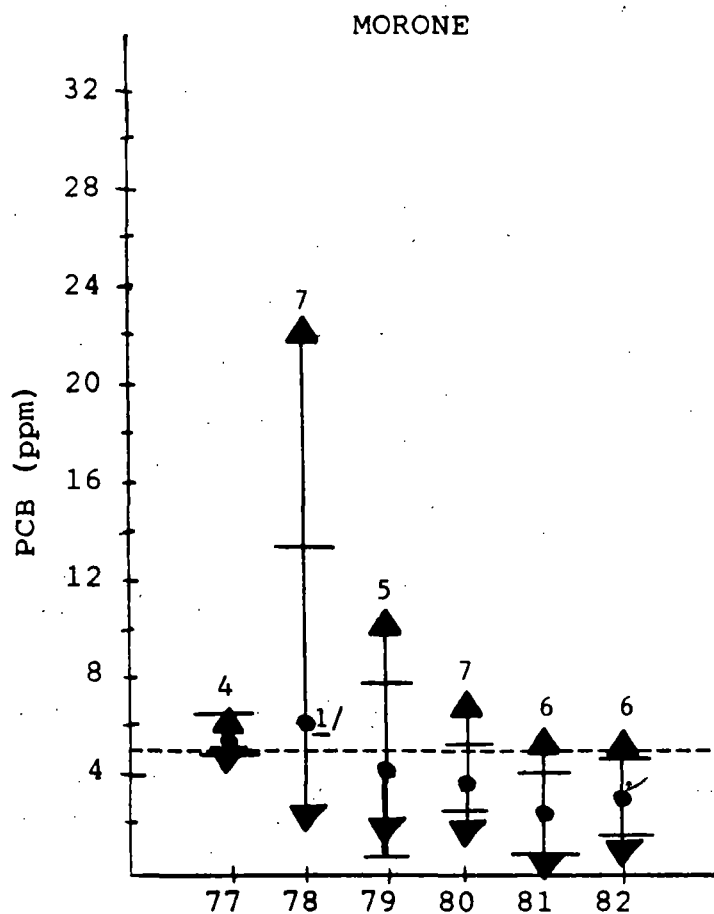
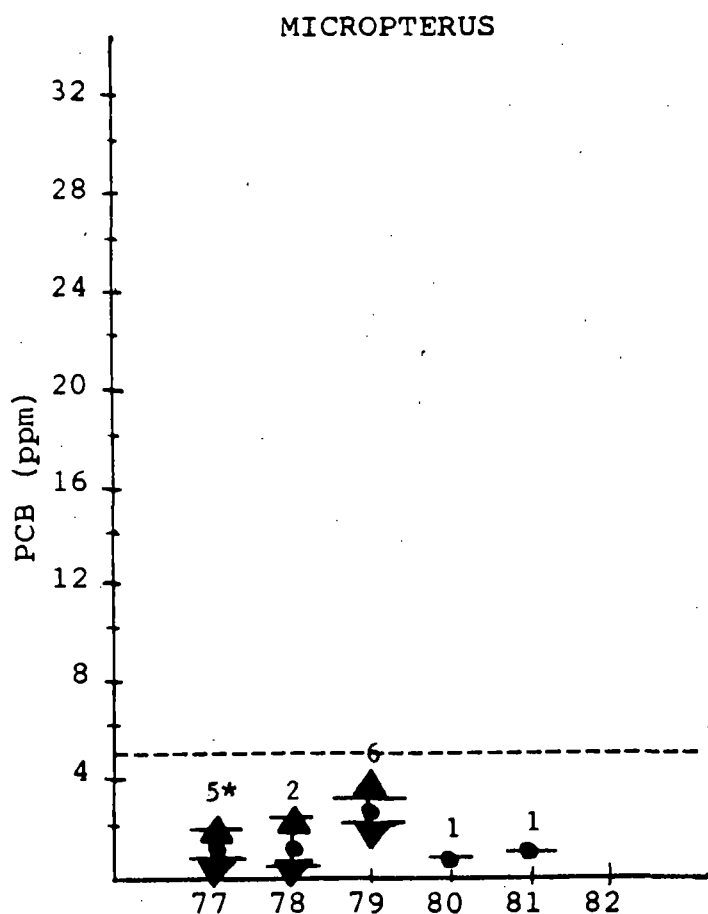
Station	1977	1978	1979	1980	1981	1982
Twelve Mile Creek		1.12F	3.26	28.30	1.36	9.15
Camp Creek	0.65			0.38	1.07	
Andersonville Island		0.57		0.41		

Figure 2. Twelve Mile Creek -- Spring.

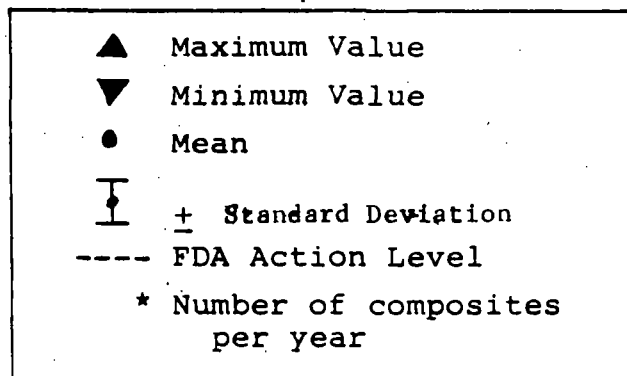


1/NOTE: Mean - standard deviation is -11.3 (not shown)

Figure 3. Camp Creek -- Spring.



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1/NOTE: Mean - standard deviation is -0.9 (not shown)

2/NOTE: Mean - standard deviation is -2.06 (not shown)

Figure 4. Andersonville -- Spring.

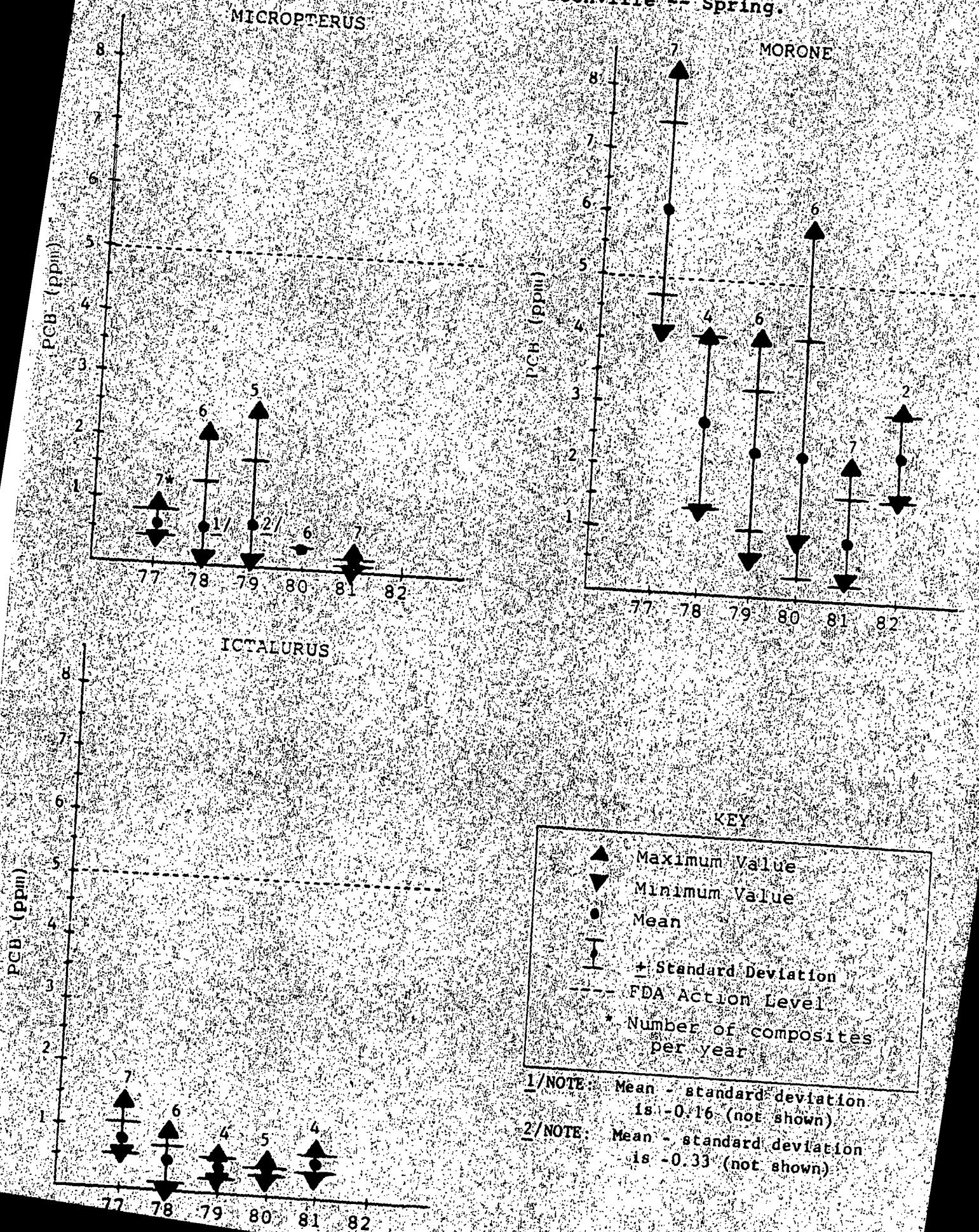
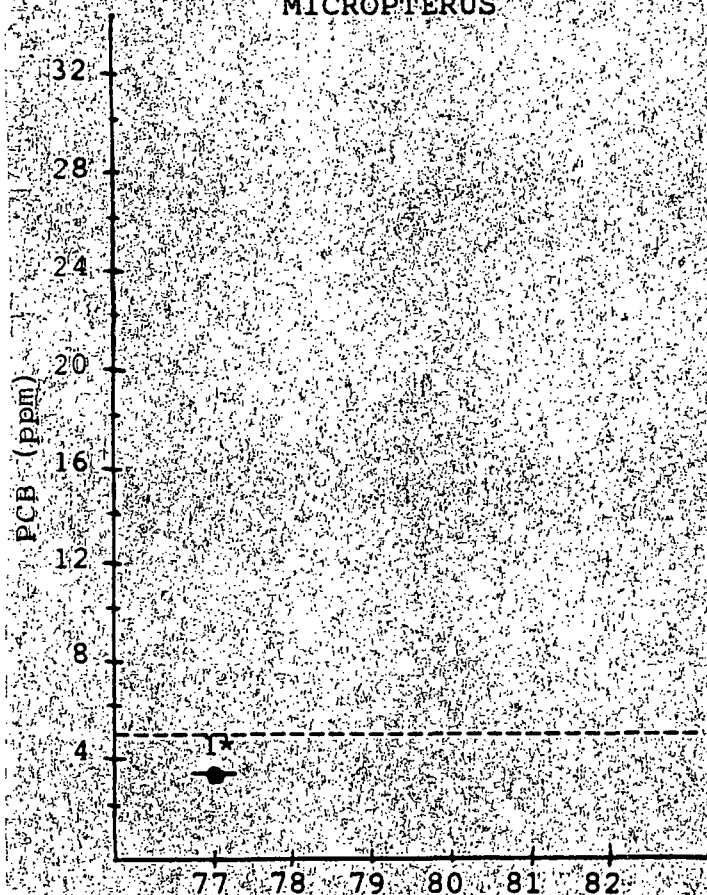
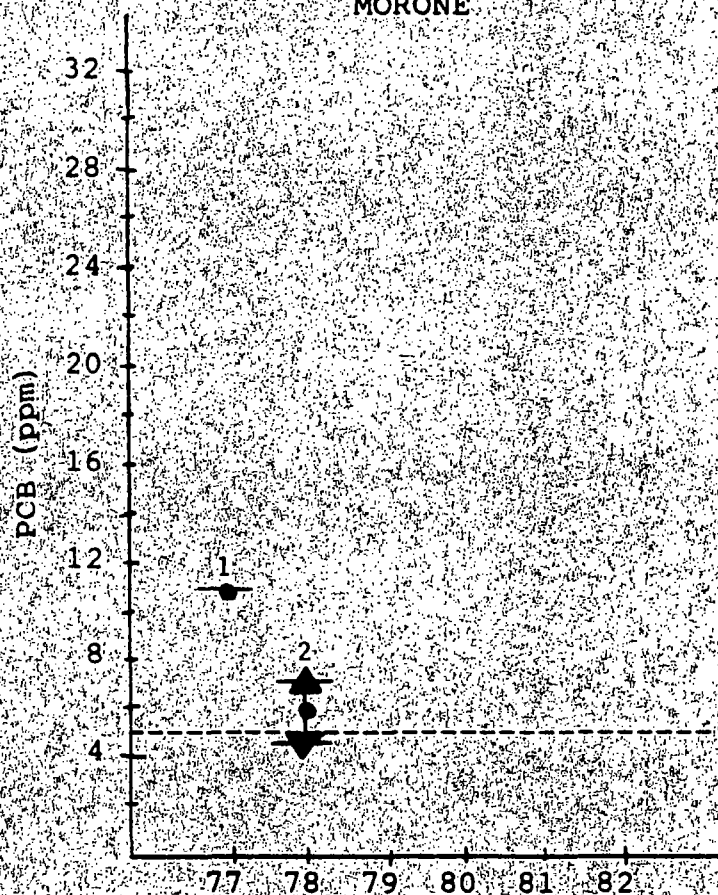


Figure 5. Twelve Mile Creek -- Fall.

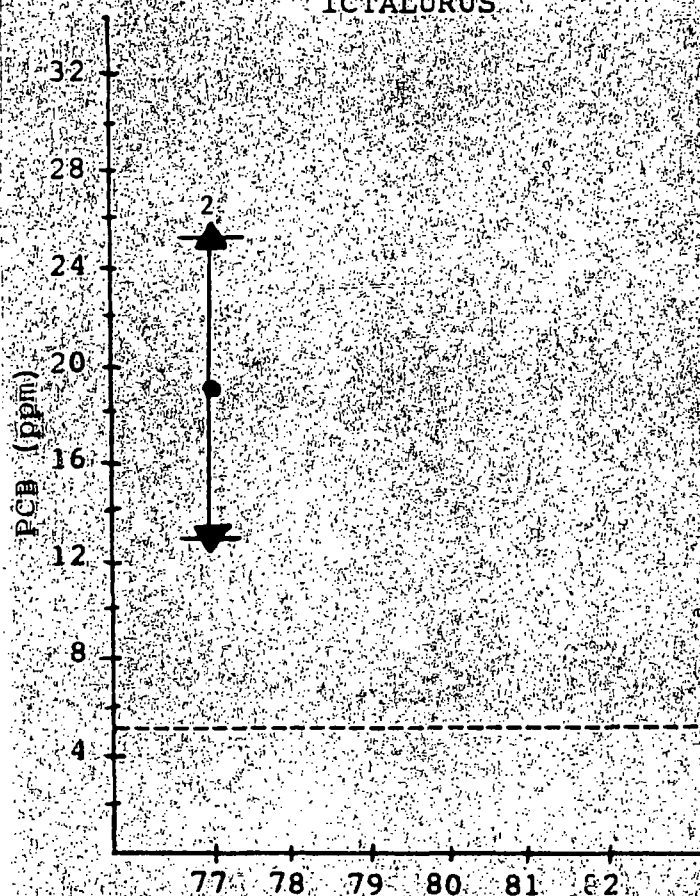
MICROPTERUS



MORONE



ICTALURUS



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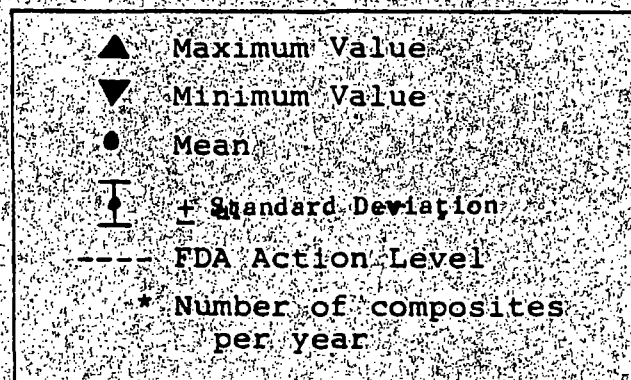
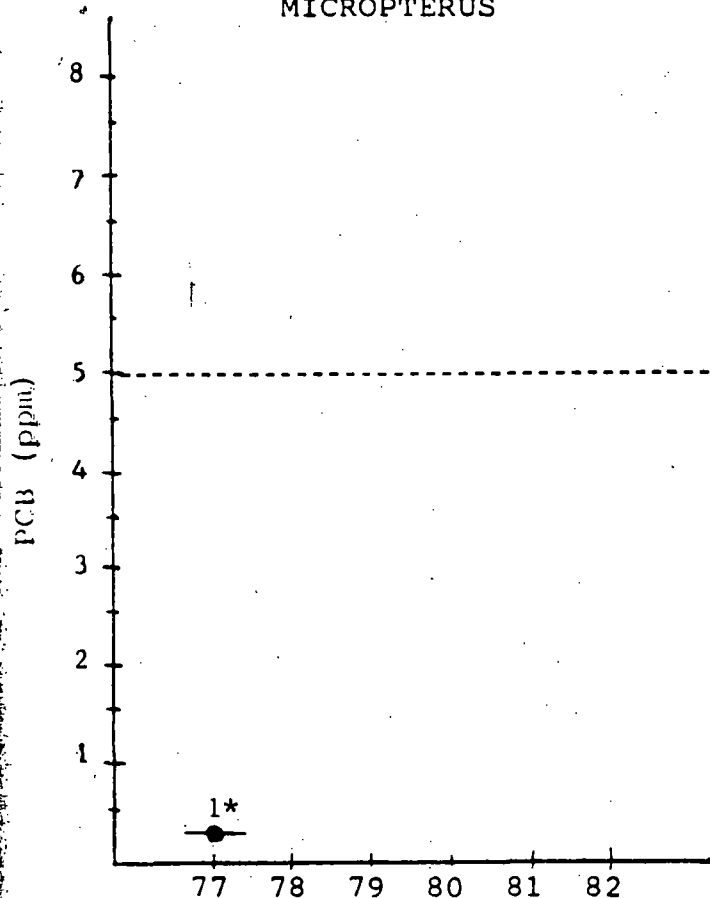
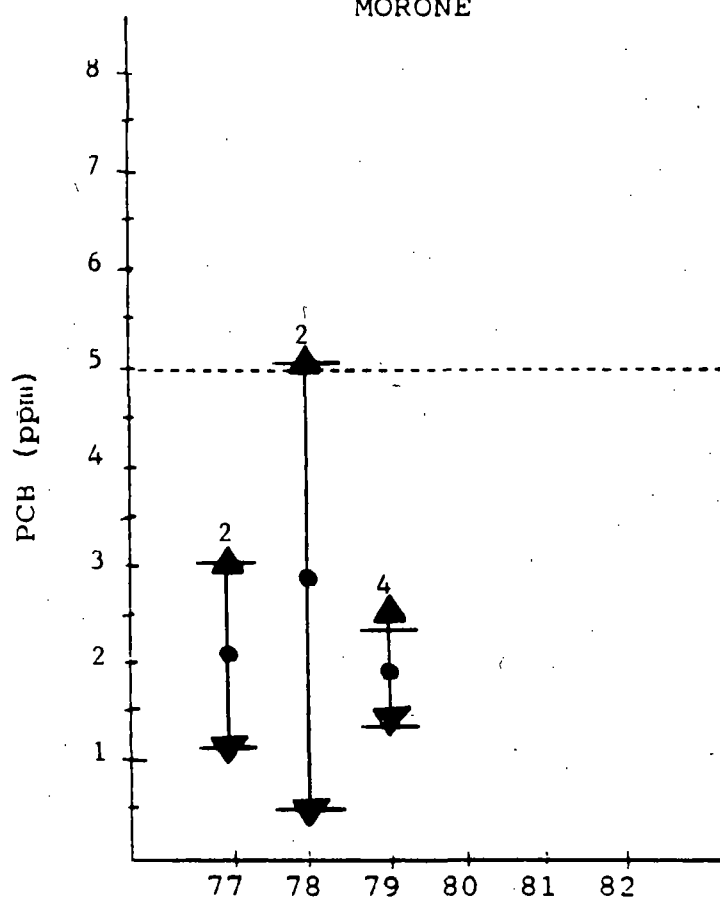


Figure 6. Camp Creek -- Fall.

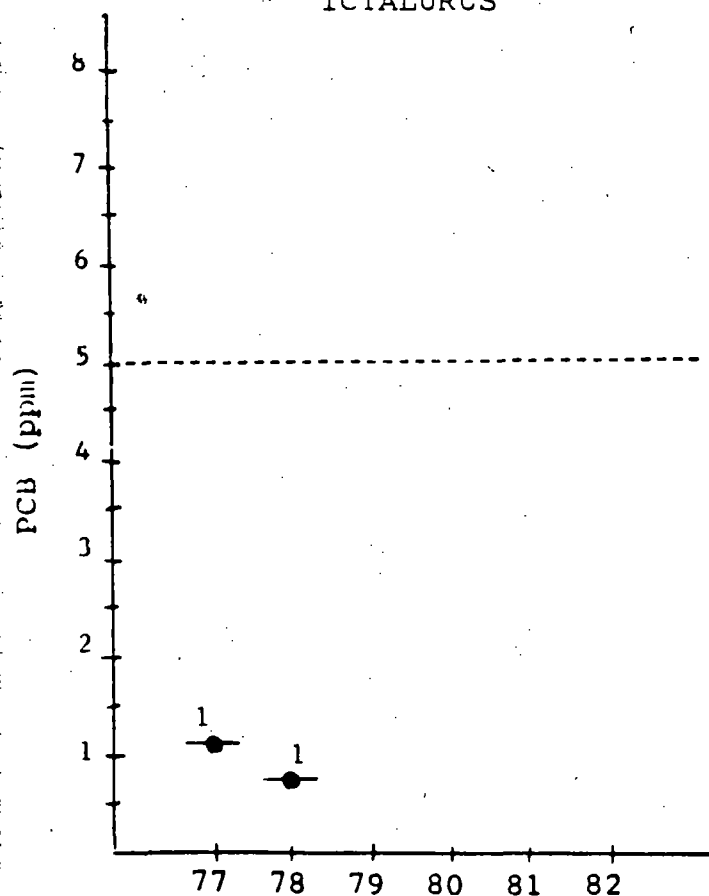
MICROPTERUS



MORONE



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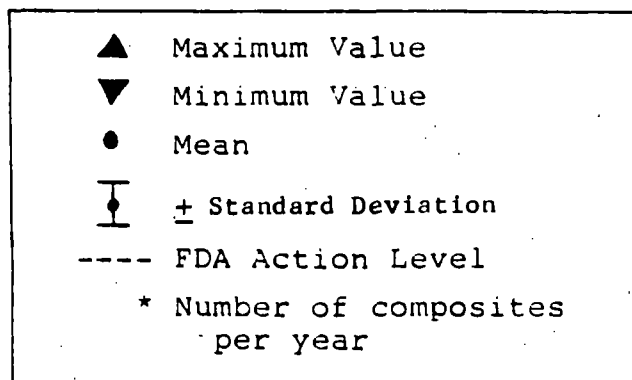
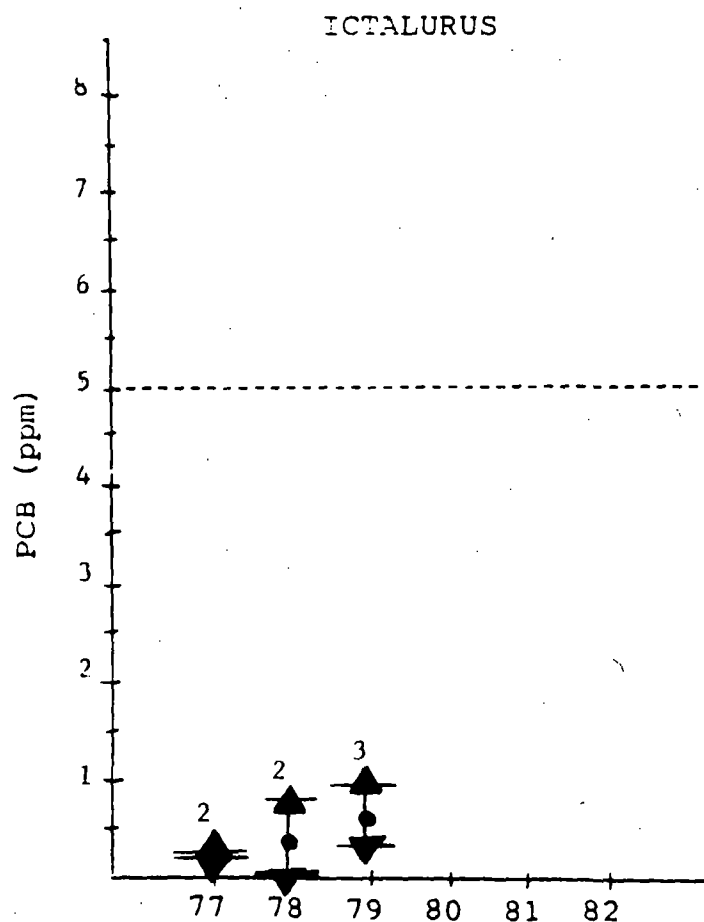
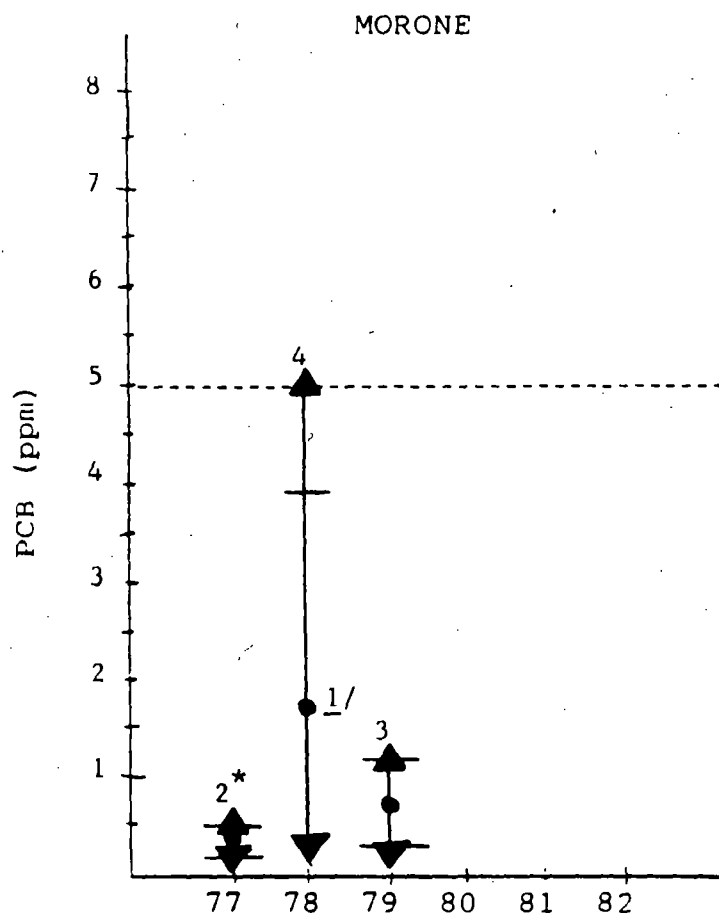
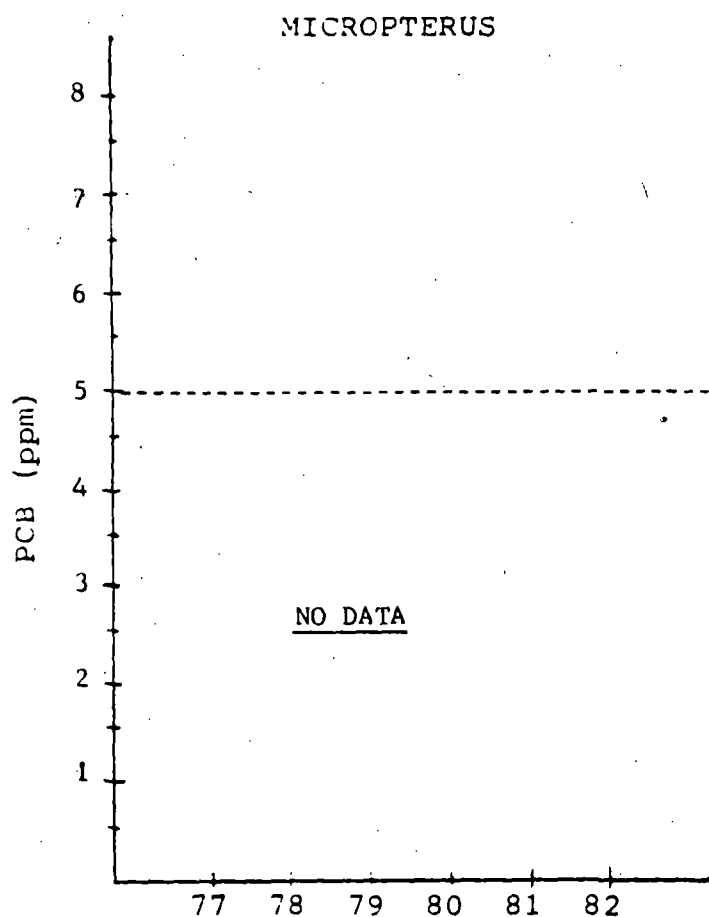
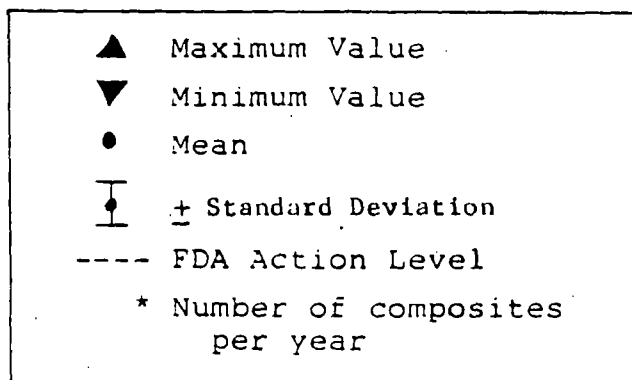


Figure 7. Andersonville Island -- Fall.



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1/NOTE: Mean - standard deviation is -0.51 (not shown)